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**ACTUARIAL REVIEW REPORT  
FOR  
THE STATE OF MONTANA  
TEACHERS RETIREMENT SYSTEM**

**OCTOBER 2004**



**Mellon**

**Human Resources & Investor Solutions**

# MONTANA TEACHERS RETIREMENT SYSTEM

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**PURPOSE AND SCOPE OF ACTUARIAL AUDIT**

An actuarial review of the Teachers Retirement System (TRS) was authorized by the State of Montana's Legislative Audit Division and the Teachers' Retirement Board in 2004. The actuarial review includes a full reproduction of the July 1, 2004 actuarial valuation results prepared by the TRS actuary, Milliman, and a review of recent experience studies and actuarial assumptions and methods used in the valuations. Mellon was selected to perform the actuarial review.

As an independent reviewing actuary, we have been asked to express an opinion regarding the reasonableness and accuracy of the valuation data, actuarial assumptions, actuarial cost methods, and valuation results. This report documents the results of our review.

The scope of the audit included both a technical review of the valuation results and a professional peer review of the actuarial assumptions and methods used by Milliman USA, the current actuary. This review involved:

- verifying that the data from TRS was complete and comparing it to the final actuarial data that Milliman used to determine if reasonable assumptions were used to complete missing data
- reviewing sample test lives from Milliman that showed the details of the valuation calculations
- checking numbers in the valuation report for accuracy
- comparing the applicable Montana statutes with the benefits being valued
- reviewing the actuarial value of asset calculations and methodology
- comparing assumptions with those used by other similar systems
- replicating the 2004 actuarial valuation results, making comparisons to Milliman's results, and noting any material differences.

**PRINCIPAL FINDINGS**

We are pleased to report that we did not find any significant errors or concerns regarding the valuation prepared by Milliman. We found the work to be reasonable and performed in accordance with generally accepted actuarial principles and practices. We found some areas where we suggest making changes to the current approach, but these are not areas that would have a material impact on the valuation results. Our recommendations can be found on pages 23 and 25.

## **SECTION II. INTRODUCTION**

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### **BACKGROUND**

TRS is responsible for administering the retirement plan for most professional and certified employees of school districts in the State of Montana. Members also include university faculty members who participated in TRS prior to July 1, 1993 and College of Technology staff who participated prior to July 1, 1995.

The current actuary for TRS is Milliman, from the office located in Seattle, Washington. They have recently completed their biennial actuarial valuation for the plan year beginning July 1, 2004 and provided us with a draft of results. We requested copies of the actuarial reports prepared by Milliman covering the plan years beginning July 1<sup>st</sup> 2000 and 2002, experience studies covering active member demographic experience, and the economic assumption study completed in 2004. These reports were either supplied to us or were available on the TRS website.

The objectives of our actuarial review can be summarized as follows:

- Assess the validity, completeness, and appropriateness of the member data, and demographic and financial information used by Milliman in the actuarial valuation of TRS.
- Assess whether the valuation method and procedures used by Milliman are reasonable and consistent with generally accepted actuarial standards and practices, are appropriate for the System's structure and funding objective, and are applied as stated in the Milliman valuation reports. We will report any deviations from accepted standards.
- Assess whether the actuarial valuation assumptions are reasonable and consistent with generally accepted actuarial standards and practices, are reasonable based on the Systems' experience, and are appropriate for the Systems' structure and funding objectives.

This report is intended to document our independent analysis of the work performed and the conclusion reached during the period under review, and provide TRS with recommendations and conclusions for improving the future funding requirements of TRS's retirement funds.

### **ACTUARIAL PROCESS**

The TRS actuary prepares a biennial actuarial valuation to determine the funded status of the system at the valuation date and the employer contributions that are necessary, along with investment return and employee contributions, to fund the promised pension payments. The valuation is a "snapshot" in time which measures the current value of expected future pension payments and balances this "liability" with the value of current assets and future funding needs. The funding methodology involves advance funding, or prefunding, so that assets are accumulated to pay for future benefits for current employees. The reasons for this advance funding include:

- Increasing the security of promised (and legislated) benefits by accumulating assets in an orderly manner.

## SECTION II. INTRODUCTION

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- Providing for the equitable treatment of different generations of taxpayers by assigning reasonable retirement system costs to each year.
- Providing a method that appropriately recognizes costs over the working lifetime of both current and prospective members of the Retirement System. The infusion of new members replacing members who terminate, retire, and die makes funding a dynamic process.

Each year's valuation involves the determination of the liabilities for benefits promised to TRS members, the calculation of the amount of assets currently available in the trust funds to pay for those benefits, and the determination of the actuarial soundness of statutorily required employee and employer contributions. Membership demographic data is merged with a pension model incorporating the TRS benefit structure and anticipated future experience. Typically, a funding policy is established by the governing body with the goal of achieving reasonably level contributions and attaining an asset accumulation which provides adequate benefit security. The key elements of the valuation process which implement the funding policy are as follows:

- Membership data – demographic information is collected as of the valuation date and expected future pension payments are determined for each member of the system.
- Benefit levels – structure of promised benefits defined under state statute which are payable upon retirement, withdrawal, disability, or death.
- Actuarial assumptions – these represent the actuary's best guess of future experience under TRS and form the basis for estimating future benefits and determining plan liabilities.
- Asset valuation method – the methodology used to assign a value to the current assets on hand; the value can be market value, book, or some smoothed or averaged value. The primary purpose of an asset valuation method which differs from market value is to smooth out volatile market fluctuations so that the goal of level contributions is supported.
- Funding method – the procedure used to allocate the costs of the promised benefits, to specific years. Various methods aim to smooth costs or benefits, or fund for benefits as they accrue.

The ultimate cost of a pension program over time equals the benefits paid and expenses incurred while administering the program. The source of revenue used to pay for this cost is equal to the contribution from employers and employees to fund the program, plus investment return earned on contributions made through pre-funding the benefit payments.

### SECTION III. REVIEW OF MEMBERSHIP DATA

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As part of Mellon's actuarial review of TRS, a thorough data analysis was performed on the member information used for the current actuarial valuation completed as of July 1, 2004. TRS supplied Mellon with the same active, inactive, pensioner and beneficiary data that was used for the July 1, 2004 actuarial valuation performed by Milliman.

Our objectives in this process were to:

- Check for validity and completeness of member data
- Check for necessary data elements

Our data review is based on a comparison between the data provided to us from TRS and the data summarized and used in the Milliman actuarial valuation reports. We requested TRS to submit to us the same data files in the same format as was supplied to Milliman to perform the July 1, 2004 actuarial valuation. The results of our analysis follows.

#### COMPLETENESS OF DATA

When performing the actuarial valuation, the actuary typically reviews the data to ensure the data fields are populated with reasonable information, that the data supplied recognizes the proper membership group at the valuation date, and no member is valued more than once. To accomplish this, the data is screened for valid information and is often matched to the prior year's final valuation data to account for status changes. This will often result in fewer active members included in the valuation than are supplied on the systems' data files.

#### *Active Members*

TRS creates a data file for the actuary that includes active members, non-members, and participants who are no longer active with termination codes. According to the legend received from TRS, the active status codes are:

- 20 – Active
- 27 – Rehired
- 40 – Rehired Retiree

Starting with the TRS data, we found 18,257 active records compared to Milliman's final groomed valuation data of 17,614. The difference of 643 records is attributable to two reasons. First, Milliman valued 637 records, where the pay was less than \$1,000, by adding contribution balances with interest to the active liability. We believe this is a reasonable estimate for liability purposes. Secondly, the TRS data file included 6 active records that had zero pay for the prior fiscal year, 3 of which had contribution balances.

In reviewing the active data from TRS, we found 169 records with blank fields for dates of birth, or almost 1% of all active members of the system. For these participants, Milliman fills in the birthdates to give the participant an age of 18 at hire date. We believe a more reasonable approach would be to choose an age that reflects the average entry age of 33. We also suggest that this data

### SECTION III. REVIEW OF MEMBERSHIP DATA

assumption be added to the procedures portion of the valuation report. This estimate should not have a material impact on valuation results, given the small amount of missing data.

The TRS file contained 5,013 part-time participants. For these participants, Milliman adjusted the accumulated service to reflect “full time” service. This adjustment was made by dividing the accumulated service by the part-time percentage. Using this logic, we agreed with all but 9 records. In these 9 cases, Milliman used the accumulated service received from TRS.

The annual pay used in Milliman’s valuation was actual earnings in the prior fiscal year. There is a discrepancy in 170 part-time records between the TRS pay and Milliman’s annual salary.

Milliman data matched TRS data exactly for contributions, vesting service, and gender.

#### ACTIVE DATA SUMMARY

Below is a summary of our data comparison to Milliman.

#### Comparative Summary of Actuarial Valuation Results Between Milliman and Mellon as of July 1, 2004

Noncontributory	Milliman Total	Mellon Total	Percent Difference
1. Number			
Active	17,614	17,617	0.0%
Active, pay < \$1,000	637	637	0.0%
Retirees and beneficiaries	10,375	10,375	0.0%
Inactive	<u>1,620</u>	<u>1,607</u>	<u>-0.8%</u>
Total Number	30,246	30,233	0.0%
2. Total Compensation (\$ Thousands)			
- Full-Time	\$ 510,808	\$ 510,808	0.0%
- Part-time	<u>60,345</u>	<u>60,063</u>	<u>-0.5%</u>
- Total	\$ 571,153	\$ 570,871	0.0%
3. Accumulated Contributions with Interest (\$ Thousands)	\$ 691,816	\$ 691,816	0.0%
4. Active Averages			
Age	45.6	45.6	0.0%
Service	12.2	12.2	0.0%
Compensation – Full Time	\$ 40,537	\$ 40,537	0.0%

## SECTION III. REVIEW OF MEMBERSHIP DATA

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### *Retired and Inactive Members*

The TRS retiree file supplied to Milliman had 10,420 retiree records. Of these records, 42 were coded as rehires, 1 coded as a nonmember, 1 coded as active, and 1 coded as a refund. The remaining 10,375 records matched the count used by Milliman in the valuation.

The total of retiree benefits matches exactly. Milliman shows a total of \$159.8 million in benefits, an average of \$15,400 per person which corresponds exactly to the TRS data.

Milliman's count for each member category matches with the TRS data: retiree, disabled, and beneficiary. Milliman data also matched TRS data for dates of birth, annual benefit, contributions, vesting service, gender, and payment form.

The TRS deferred vested member file has 1,607 records compared to 1,620 records on the Milliman file. The 13 additional records all had a benefit of zero; 11 TIAA-CREF and TRS members, 2 TRS members with no pay.

Milliman deferred vested member data matched TRS data for dates of birth, annual benefit, contributions, gender, and deferred retirement to age 60.

### **SUMMARY OF RETIREE AND INACTIVE DATA**

Overall, the Retiree and Inactive data provided by TRS was very complete.

In comparing the TRS data to the Milliman valuation data, we found some minor differences, but none that were significant or that would lead to major differences in valuation results.

Finally, we recommend that Milliman add information to the valuation report on what procedures are used to estimate missing data. This includes assumptions and procedures that are used to complete missing dates of birth, sex codes, service dates, or salary amounts.

### **NECESSARY DATA ELEMENTS**

All necessary data elements were present on the TRS data tapes in order to calculate liabilities for active, inactive, and retired members and beneficiaries. However, we do have some suggestions that can improve valuation precision:

For the active member file:

- Include an annual rate of pay in addition to prior year's pay. This will make valuing new hires in the previous year more accurate, eliminating the need for the actuary to annualize partial year pay.

### **SECTION III.            REVIEW OF MEMBERSHIP DATA**

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- Remove records from the active TRS tape when a participant is no longer active, deferred vested or due a refund. Use a single code to specify the status of an active, deferred vested or refund-due participant.
- Review the records missing gender and dates of birth to see if the information is available.

For all data assumptions:

- TRS should work to reduce the number of missing dates of birth passed to the actuary. This can often be accomplished by requiring complete information on enrollment forms received from participating employers.

## SECTION IV. ACTUARIAL ASSUMPTIONS

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### BACKGROUND ON ACTUARIAL ASSUMPTIONS

The actuarial assumptions form the basis of the actuary's best guess of future benefit payment amounts. Since it is not possible to know in advance how each member's career will evolve in terms of salary growth, future service and cause of termination, the actuary must develop assumptions in an attempt to predict future employment and benefit payment patterns. These assumptions enable the actuary to value the amount of benefits earned and to reasonably predict when these benefits will be paid. Similarly, the actuary must make an assumption about future investment earnings of the trust fund. In developing the assumptions, the actuary examines the past experience and considers future expectations to make his or her best estimate of the anticipated experience under the plan. There is no one right assumption, but each assumption has a range of reasonable alternatives.

Traditionally actuarial assumptions have been considered either "explicit" or "implicit." Under the explicit approach each individual assumption represents the actuary's best estimate of experience with respect to that assumption. Under the implicit approach the assumptions in the aggregate represent the actuary's best estimate of future experience, but each individual assumption does not necessarily represent the actuary's best estimate. The explicit approach to assumptions is required under ERISA and the Internal Revenue Code. Although TRS is not subject to ERISA, standard actuarial practice today tends to be based on the explicit approach to selecting assumptions. The TRS actuary has been following the explicit approach.

There are two general types of actuarial assumptions:

- Economic assumptions – these include the valuation interest rate (expected return on plan assets), assumed rates of salary increase, inflation, cost-of-living increases (if applicable), and increase in total payroll.
- Demographic assumptions – these include the assumed rates of mortality (both before and after retirement), disability, retirement, and withdrawal before and after eligibility for a vested benefit.

For purposes of our review, we will focus on the TRS assumptions and their reasonableness. We will review the most recent experience analysis reports and comment on the reasonableness of assumption changes given plan experience and make comparisons with national surveys and assumptions used by other similar regional retirement systems.

### ECONOMIC ASSUMPTIONS

The key economic assumptions are the valuation interest rate (expected return on plan assets and forms the basis for discounting future benefit payments), the salary scale (or assumed rates of salary increase), the increase in total payroll (since unfunded liabilities are amortized over an increasing payroll), and inflation. Since inflation impacts both salary increases, COLAs and asset return, it is important to equally reflect the underlying inflation rate in the valuation interest rate, the COLA assumption and the salary scale assumptions. In addition, Milliman makes an assumption for total payroll increases that should also be consistent with other economic assumptions and TRS expected experience.

## SECTION IV. ACTUARIAL ASSUMPTIONS

**Valuation Interest Rate:** The valuation interest rate should represent the long-term rate of return expected on the actuarial value of assets, considering the real rate of return on the plan's assets, the underlying inflation rate, expenses, and future contributions. The period considered for funding represents a long time horizon. In reviewing this assumption, the actuary should consider TRS's asset allocation policy, history of returns and expectations of any future economic implications.

Earlier this year, the TRS actuary performed an experience analysis on economic assumptions. The actuary considered historical TRS investment returns, general economic trends, and a projection of expected investment returns using capital market assumptions. The actuary recommended a decrease from 8.0% to a 7.75% assumption for investment return, net of expenses, with an underlying price inflation of 3.5%, resulting in a real rate of return assumption of 4.25%.

The TRS asset allocation on June 30, 2003, was 63% equities (includes international and private equity) and 37% fixed income. Below is a comparison of TRS's valuation interest rate and asset allocation to several similar regional statewide retirement plans.

**Valuation Interest Rates and Asset Allocations**

Retirement System	Valuation Interest Rate	Asset Allocation (Equity-like vs. Fixed Income)
TRS	7.75%	63%/37%
Utah RS <sup>(2)</sup>	8.0%	68%/32%
Idaho PERS <sup>(1)</sup>	8.0%	72%/28%
Montana PERS <sup>(1)</sup>	8.0%	63%/37%
North Dakota Teachers <sup>(1)</sup>	8.0%	80%/20%
South Dakota RS <sup>(2)</sup>	8.0%	74%/26%
New Mexico ERB <sup>(2)</sup>	8.0%	71%/29%
PERA of Colorado <sup>(2)</sup>	8.5%	75%/25%
Wyoming Retirement System <sup>(2)</sup>	8.0%	63%/37%
2004 Wilshire Survey (Average) <sup>(1)</sup>	8.0%	65%/35%

(1) 2004 Wilshire Report on the State Retirement Systems: Funding Levels and Asset Allocation, March 12, 2004

(2) Survey of Mellon governmental clients

TRS's valuation assumption appears consistent with comparable systems, and is slightly conservative when compared with the average Wilshire survey results. In a recent Mellon study, almost 39% of the plans surveyed used an 8.0% valuation interest rate, the most common interest rate used. This concurs with a recent Public Fund survey published by NASRA that indicated the median valuation interest rate assumption for 125 public plans surveyed was 8.0%. Return expectations of investment professionals have declined recently. Although some retirement systems have decreased their valuation interest rates, many systems have not.

## SECTION IV. ACTUARIAL ASSUMPTIONS

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When recommending valuation interest rates, actuaries must consider the long-term expected rate of return on plan assets given the plan's asset allocation policy, and also consider historical statistical data. Real long-term rates of return on equities typically range from 6% to 7% and real long-term rates of return on fixed income range from 2% to 3%. When considering TRS's current asset allocation, expenses, and assumed inflation of 3.5% annually, the nominal return of the portfolio reasonably falls within a range of 7.7% to 8.7%. Therefore, we find Milliman's recommended 7.75% valuation interest rate and underlying real rate of return within the reasonable range, although at the low (conservative) end of the range.

**Inflation:** Recent inflation rates have been lower than in the 1970s and 1980s. The inflation rate under the CPI-U index over the ten-year period ending December 31, 2004 was as follows:

**Inflation Rates**

Year	CPI-U Index
1994	2.6%
1995	2.8%
1996	3.0%
1997	2.3%
1998	1.6%
1999	2.2%
2000	3.4%
2001	2.8%
2002	1.6%
2003	2.3%
Geometric Mean:	
Last 5 years	2.5%
Last 10 years	2.5%
Since 1960	4.4%

In the 2004 economic experience report, Milliman recommends decreasing the inflation assumption from 4.0% to 3.5%. The recommended inflation rate of 3.5% is greater than the average inflation over the last ten years (2.5%), but less than inflation experienced since 1960 (4.4%). This assumption has been trending down as a result of recent low inflation. Although many economists currently forecast inflation of less than 3%, long-term rates should be higher given the historical record of inflation. We believe long-term inflation assumptions ranging from 3% to 4% are reasonable. According to the recent NASRA survey of public plans, the median inflation assumption was 3.75%, with 67% of plans using an inflation assumption of 3% to 4%. In our opinion, a long-term inflation rate of 3.5% per year recommended by Milliman is reasonable.

## SECTION IV. ACTUARIAL ASSUMPTIONS

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**Salary Scale:** The salary scale, or assumed annual rates of salary increase, is the other key economic assumption. An analysis of the appropriateness of the salary scale needs to consider two points. First, how does the rate of actual salary increases compare with those expected according to the actuarial assumptions. Second, are the two economic assumptions (interest rate and salary scale) internally consistent with regard to the underlying inflation assumption.

The salary scales used for TRS consist of two components. The first component is the rate of general wage inflation. This is comprised of the price inflation assumption that is inherent in the development of the valuation interest rate, plus an economic productivity assumption. Milliman recommends a decrease in the general wage inflation assumption from 5.0% to 4.5%. The recommended assumption includes the same price inflation assumption of 3.5% inherent in the valuation interest rate. Productivity of our economy creates salary increases that are greater than price increases (inflation). Assumptions generally range from 0.5% to 1.5% for most plans to reflect economic productivity. We find Milliman's productivity assumption of 1.0% reasonable, and therefore, a general wage inflation of 4.5% to be reasonable.

The other component of the salary scale varies by service and measures merit or step/longevity increases. The merit/step/longevity component for general members ranges from 4.51% during the first year of service, grading down to 0% after 22 years of service. This component can be applied to salary increases by age, by service, or by a combination of age and service. We generally find rates starting at 5% to 6%, and grading down over time to 0%. Although a starting merit/step/longevity increase rate of 4.51% is lower than we typically see, we find the scale reasonable given TRS experience. The merit/step/longevity component used for university members is a flat 1.0%. Given the university members participating in TRS were hired before July 1, 1993, this group consists of older, longer service members only who are typically expected to receive lower merit/step increases. Using a flat scale of 1.0% for this group is reasonable.

Another consideration in examining the package of economic assumptions is to look at the spread between the valuation interest rate and the general wage inflation; also known as "economic spread." In a 2002 Wisconsin survey of 85 major public employee retirement systems, the average spread was 3.87%. Economic spread ranged from a low of 1.75% to a high of 5.50%, with 3.50% being the most common. Economic spreads should directly correlate with the expected real rate of return of a plan's asset allocation. Higher allocations to equity, and hence higher expected rates of return, should result in higher economic spreads.

## SECTION IV. ACTUARIAL ASSUMPTIONS

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We believe an economic spread between 3% and 4% is reasonable for TRS. Milliman's recommended economic assumptions include a spread of 3.25%. We find Milliman's economic spread slightly conservative, but reasonable. Following is a table showing the economic spread of other similar retirement plans:

**Economic Spread**

Retirement System	Rate
TRS	3.25%
Idaho PERS <sup>(1)</sup>	3.25%
Montana PERS <sup>(1)</sup>	3.75%
North Dakota Teachers <sup>(1)</sup>	5.00%
New Mexico ERB <sup>(2)</sup>	3.50%
PERA of Colorado <sup>(2)</sup>	4.00%
South Dakota RS <sup>(2)</sup>	3.50%
Utah RS <sup>(2)</sup>	3.25%
Wyoming RS <sup>(2)</sup>	4.00%

<sup>(1)</sup> 2002 Comparative Study of Major Public Employee Retirement Systems (Wisconsin)

<sup>(2)</sup> Survey of Mellon Governmental Clients

**Increase in Total Payroll:** As part of determining the actuarial contribution rate, the unfunded accrued liability is amortized over a 30-year period as a level percent of pay for the general membership group. Since pay is expected to increase, an assumption is made for the rate at which total payroll is expected to increase. The amortization payment will remain level as a percentage of total payroll for the general membership group provided:

- the active general employee membership group (excluding university system employees) remains at a constant or stationary level, and
- the underlying long-term price inflation rate and productivity increases are realized
- the general member payroll grows by 4.5%
- the contribution rate for the university system's unfunded liability, currently 4.04% of pay, is properly adjusted to amortize the MUS past service liability by July 1, 2033

This procedure for amortizing unfunded accrued liabilities is common for large public plans. However, this methodology increases the risk of future funding shortfalls since adequate funding is dependent on a stationary or growing active membership group needed to meet the assumed payroll growth rate. If active membership decreases, contributions will need to be increased in order to meet the amortization period. Accounting Standards (GASB No. 25 & 27) do not allow an assumption for population increases when setting a payroll growth assumption.

## SECTION IV. ACTUARIAL ASSUMPTIONS

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It is difficult to determine what the recent salary increase experience has been for the general membership group (excluding university members) from available information. Historical information of average salaries is based on combined salaries for these groups. However, since salary increases used to determine the benefit liability for the plans are consistent with the 4.50% payroll growth assumption, a corresponding reduction in the wage inflation and payroll growth assumption would not have a significant impact on the determination of the funding period.

### DEMOGRAPHIC ASSUMPTIONS

The demographic assumptions are the assumed rates of retirement, withdrawal (with or without a vested benefit), disability and mortality (death before or after retirement). These decrements define the member status changes which effect the payment of benefits. Since TRS is a large retirement system, the demographic assumptions should reflect the system's own experience. To this end, the TRS actuary should prepare periodic experience studies to review the current actuarial assumptions and revise them as necessary. Milliman reviews experience on even numbered valuation years. In the 2002 valuation report, Milliman made several assumption changes, but the underlying experience and analysis justifying those assumption changes were documented in the active member experience analysis report. Mortality table changes made in 2000 followed the mortality experience analysis completed in 1999. Our comments regarding the current assumptions and the recent changes follow.

***Rates of Retirement:*** These rates form the basis of determining the expected future benefits paid upon early, normal, or late retirement. Unreduced benefits are available after 25 years of service credit or after reaching age 60 with at least five years of service credit. Reduced benefits are also available after becoming eligible for early retirement. Reduced early retirement benefits are available after 5 years of service credit and attaining age 50. Members who leave before eligibility for a service retirement are not eligible for immediate benefit payments, but are eligible for a future benefit if vested.

It is our experience that employees will often wait until they are eligible for unreduced benefits to retire, and therefore, the incidence of retirement after attaining eligibility for unreduced benefits is higher than when eligible for a reduced retirement benefit. Members electing to continue working until after becoming eligible for a retirement benefit may work a number of years into late retirement.

The retirement rates used by Milliman are structured to coincide with retirement eligibility and are based on age and eligibility for unreduced and reduced retirement. The use of retirement rates from age 50 to age 59 is reasonable given the eligibility for reduced retirement benefits, and are lower than rates for unreduced retirement. Unreduced retirement rates are higher when first eligible, and reduce thereafter. Late retirement rates continue after age 60 until age 70, a typical ultimate retirement age. We generally find the retirement assumptions reasonable and consistent with other similar Systems.

***Rates of Withdrawal (Before and After Eligibility for Vested Benefits):*** A member who terminates employment with at least five years of service may choose to receive a refund of contributions with interest or a deferred vested pension. Members terminating with less than five years of service may receive a refund of member contributions with interest after filing an application for a refund. To calculate withdrawal liability after five years of service, the valuation assumes that a percentage of

## SECTION IV. ACTUARIAL ASSUMPTIONS

the members choose to defer their benefits and the remaining percentage will elect a refund of contributions upon termination. This percentage varies by age. For example, if a member age 30 leaves with five or more years of service then the valuation assumes that 46% take the refund and 54% retain membership and receive a deferred monthly benefit, whereas if a member age 45 leaves, the valuation assumes that 40% take a refund and 60% will receive a deferred monthly benefit.

To value these benefits, Milliman uses withdrawal rates that are a function of years of service, with slightly different rates for general members vs. university system members. Actuaries will either set rates by age, by service, or by a combination of age and service, depending on the best fit of experience. A comparison with similar systems follows.

### Withdrawal Rates

Age	Service	Montana TRS (General Members)	Montana PERS		Colorado PERA (School Division)		Utah Retirement System (Public Educators)	
			Male	Female	Male	Female	Male	Female
20	1	.300	.250	.250	.150	.160	.159	.267
25	2	.160	.160	.160	.120	.125	.122	.188
30	5	.080	.060	.050	.050	.067	.043	.084
35	10	.062	.030	.040	.035	.049	.029	.052
40	15	.042	.020	.020	.028	.036	.021	.035
45	20	.030	.020	.020	.025	.031	.016	.027

The withdrawal rates used by Milliman are based on the System's experience, and unlike some systems, are not determined separately by gender. However, they are comparable to rates used by similar systems, and appear reasonable.

***Rates of Disability:*** If a member gets disabled prior to retirement with at least five years of service, he or she is eligible for a disability benefit. Rates of disability are used to quantify the value of this benefit. These rates are set on the basis of age and increase as age increases. Rates are applied separately to general members and university members based on experience.

## SECTION IV. ACTUARIAL ASSUMPTIONS

One way to evaluate the disability rates is by comparison to other similar systems. Following below are some comparable disability rates for other pension systems:

**Disability Rates**

Age	Montana TRS (General Members)	Montana PERS		Colorado PERA (School Division)		Utah Retirement System (Public Educators)	
		Male	Female	Male	Female	Male	Female
25	.0001	.0001	.0001	.0001	.0002	.0001	.0002
30	.0001	.0001	.0001	.0001	.0003	.0002	.0003
35	.0002	.0006	.0003	.0004	.0005	.0003	.0005
40	.0004	.0009	.0015	.0011	.0008	.0004	.0006
45	.0008	.0017	.0015	.0018	.0010	.0007	.0010
50	.0013	.0036	.0030	.0040	.0030	.0009	.0013
55	.0018	.0062	.0036	.0065	.0050	.0014	.0021

The disability rates for TRS are based on the actual experience of the System and appear reasonable. However, other systems in our sample separate disability rates by gender. Since the disability experience is relatively small, we don't expect that separate disability rates by gender for TRS would have a material impact on the actuarial results.

**Rates of Mortality:** The most important decremental valuation assumption is mortality because this assumption is a predictor of when pension payments stop. The mortality assumption applies to members both before and after retirement. Most often, gender distinct rates are used for non-disabled members since studies continually show that females live longer than males, although that gap has been shrinking according to recent mortality studies.

The TRS actuarial valuations use established mortality tables with adjustments based on TRS experience. This is a common method for setting mortality rates when a system does not have a sufficient sample size to warrant experience-based tables. A different set of mortality rates are used for healthy vs. disabled members. In Milliman's experience analysis report, the healthy member mortality rates used in the valuation are set using the 1994 Group Annuity Mortality Table, using a setback of three years for males, and a setback of one year for females. The rates were set with a margin of 9%. This means the rates are more conservative than the observed experience, to take into account expected improving mortality during the projected benefit payment period.

## SECTION IV. ACTUARIAL ASSUMPTIONS

The following table illustrates the TRS mortality rates and how they compare to other similar systems:

**Mortality Rates – Healthy Members**

Age	Montana TRS		Montana PERS		Colorado PERA (School Division)		Utah Retirement System (Public Educators)	
	Male	Female	Male	Female	Male	Female	Male	Female
30	.00073	.00033	.00084	.00036	.00040	.00025	.00019	.00007
40	.00089	.00065	.00108	.00070	.00095	.00058	.00045	.00038
50	.00190	.00131	.00250	.00141	.00425	.00176	.00148	.00107
60	.00558	.00386	.00762	.00415	.00755	.00383	.00532	.00361
70	.01803	.01271	.02336	.01367	.02096	.01061	.01746	.01265
80	.04517	.03536	.06007	.03802	.05505	.03163	.04393	.03412

These rates appear reasonable. The TRS rate falls between the other system rates at each age for each gender.

Totally disabled members can be expected to have a shorter life expectancy than healthy retired members. Milliman is using a disabled retiree mortality to be higher than for healthy retirees and consistent with rates used for similar public retirement plans. We find the disabled retiree mortality used is reasonable.

## SECTION V. ACTUARIAL METHODS

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### ACTUARIAL COST METHODS

As discussed earlier, the ultimate cost of any retirement program is equal to the benefits paid plus the administrative costs of operating the plan. This cost is provided from contributions made to the plan plus the investment return on accumulated contributions which are not immediately needed to pay benefits or administrative costs. The level and timing of the contributions needed to fund the ultimate cost are determined by the actuarial assumptions, plan provisions, member characteristics, investment experience, and the actuarial cost method. Actuarial cost methods are calculation processes which determine and allocate the cost of a retirement plan to specific periods of time. As such, it has an influence on the level and timing of the ultimate contributions.

Different actuarial cost methods can provide for faster funding earlier in a plan's existence, more level funding over time, or more flexibility in funding. The choice of an actuarial cost method will determine the pattern or pace of the funding and therefore should be linked to long term financing objectives of the fund and benefit security considerations.

The desired pattern of funding that is influenced by the actuarial cost method will depend on the importance of the following factors to the financing of the plan:

- Budgetary limitations
- Stability of contribution rate
- Flexibility of funding
- Pace of funding
- Benefit security
- Intergenerational equity

These factors and their relative importance to maintaining the actuarial integrity of the plan are significant elements to be considered when selecting an actuarial cost method.

Changes in participant characteristics, plan experience, and investment return over time can lead to a funded status which is either more or less favorable than expected under the actuarial method used. This difference, applied differently by each cost method, adjusts the level of funding required in any one year. This adjustment can distort the true cost of benefits accruing under the plan.

The cost of accruing benefits under most methods is referred to as the normal cost. This cost is typically expressed as a percentage of pay when benefits and contributions are based on compensation. For flat or unit benefits based on service, this cost is expressed as a dollar amount per active member assumed to continue in service. The pattern of this cost varies by cost method. This cost can be expressed as a level percentage of pay over a member's full career, or can be expressed as the value of benefits accruing during the current year as a percentage of pay. The latter approach leads to an increasing normal cost pattern throughout a member's career since the initial value of accruing benefits is small and increases as a member reaches retirement age.

## SECTION V. ACTUARIAL METHODS

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At any point in time (i.e., the valuation date), the actuarial cost method may determine the accrued liability of benefits which, under the cost method, should be funded by past contributions and investment return. An unfunded actuarial liability will exist if the accrued liabilities exceed the value of assets on hand on the valuation date as measured by the asset valuation method. Although actuarial cost methods may differ in how this unfunded liability is treated, an additional cost results since future funding of this amount is not considered in the cost of accruing benefits (normal cost). This additional cost may be determined by amortizing the unfunded obligation over a period of years and adding it to the normal cost to arrive at the total cost, or it may be expressed as a percentage of future salaries and included in the normal cost determination.

The actuarial cost method used by Milliman for TRS is as follows:

- **Entry Age Actuarial Cost Method** – This method is used to determine the actuarially required contribution. This cost method determines the normal cost as a level percentage of pay for each individual member of the plan, which if paid from entry into the plan to the last assumed retirement age, will accumulate to an amount sufficient to pay the expected benefit. An additional cost is determined by amortizing the unfunded actuarial liability over a period not to exceed 30 years as a percentage of increasing payroll and is added to the normal cost to determine the total actuarially required contribution. Actuarial gains and losses adjust the unfunded liability each year.

The actuarial cost method employed by the TRS actuary will systematically fund the prospective pension benefits on an actuarially sound basis given all of the actuarial assumptions are exactly realized. We have reviewed the application of the cost methods and the amortization methodology, and in our opinion, the procedures employed are reasonable. There is an exception to the increasing payroll methodology used to amortize TRS's unfunded liability. Since the university membership participating in TRS is closed to new members, only projected payroll for current university members in TRS is used.

The Entry Age Actuarial Cost Method is the most common method used by public systems. The 2004 Wilshire Report on State Retirement Systems showed 89 out of 123 surveyed systems, or 72%, used Entry Age Normal. The Wisconsin 2002 Comparative Study of Major Public Employee Retirement Systems, published in December 2004, had 76% of the 85 plans surveyed using Entry Age Normal.

***Components of the employer contribution:*** The employer contribution is comprised of three components:

- Normal cost percentage, net of the employee contribution rate
- Amortization percentage of payroll of TRS members
- Amortization percentage of payroll of ORP members

The amortization payment on the payroll of ORP members is needed to amortize the unfunded liability attributable to benefits paid under TRS for Montana University System members. Since

## SECTION V. ACTUARIAL METHODS

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unfunded liabilities are amortized over an increasing payroll, and no new MUS members join TRS, an additional payment of the MUS portion of the unfunded liability is determined using MUS-ORP salaries.

### ASSET VALUATION METHODS

A primary funding policy goal is to have stable contributions. Large market value fluctuations make this goal difficult to achieve. Thus most actuaries use an asset valuation method which smoothes out these fluctuations in support of achieving level contributions. A good asset valuation method places values on a plan's assets which are related to current market value but which will also produce a smoother pattern of costs. This is a question of balancing fit (measured against market value) and smoothness.

Neither book nor market value of these assets is generally felt to be appropriate in determining the actuarial contribution rate for an ongoing pension plan. Book value produces smooth predictable employer contributions, but it ignores sizeable appreciation and is not a good measure of the fund's true value (i.e., a poor fit to market value). On the other hand, market value is a realistic current measure of the fund, but on a long-term basis one day's market value may not be a very meaningful figure for a pension fund. Furthermore, sharp short-term swings in market value can result in large fluctuations in the employer contributions required to fund the plan (i.e., not very smooth).

The goal of the actuarial asset valuation method is thus to smooth or reduce investment fluctuations. This is particularly important during periods of volatile capital markets in which abrupt changes in asset values, when factored into the funding valuation, produce sudden unnecessary changes in contribution levels. In this case, "unnecessary" implies that the change in asset values is not necessarily a true revaluing of the assets involved but rather a fluctuation reflecting a current economic climate or a short-term reaction to specific news.

Desirable characteristics of an actuarial asset valuation method include the following:

- The method should be simple to operate. It should be readily calculable from financial statements.
- The method should be easy to explain to all interested parties.
- The theoretical underpinnings should be solid and not produce a long-term lag to the fair value of assets. The value produced should account for market and book values,
- The method should smooth the effect of market fluctuations.
- Investment decisions should not be affected by the actuarial asset valuation method, and vice versa.
- The value produced should be realistic; the price tag placed on assets should be sensible and should not cause other variables to be adjusted to account for unrealistic asset values.

## SECTION V. ACTUARIAL METHODS

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**TRS Asset Valuation Method:** The asset valuation method used by TRS to develop the Actuarial Value of Assets (AVA) is generally referred to as a Five Year Smoothed Market Value Method. The difference between the actual return on market value of assets (MVA) and the expected return is determined each year. Twenty percent of this difference is recognized in the actuarial value of assets each year, such that after five years, the entire difference has been recognized. This becomes a rolling process where the differences from four previous years are partially recognized at 80%, 60%, 40%, and 20% of the original difference.

Theoretically, if the actual return is as expected, no new difference or base is created. If no new difference is created over a five-year period, all of the prior differences would be recognized such that no smoothing to the market value would exist. In this case, the actuarial value should equal the market value since all previous differences have been recognized.

In reviewing the Milliman methodology, the determination of the amount of recognition to be phased-in is equal to the difference between the investment income on market value and the expected amount that is immediately recognized in market value. The 20% portion of the previous five-year phase-in is then added to the previous year's actuarial value and adjusted for contributions, benefit payments, and expected return on market value during the year. The year-end funding value, plus unrecognized future phase-in amounts, equals the market value of assets at year-end. We find this method reasonable, leading to full recognition of gains and losses after five years, recognizing gains and losses equally.

To verify the Milliman methodology, we independently calculated the actuarial value of assets for the fiscal years ending in 2003 and 2004 using an alternative approach. This approach adjusts the year-end market value by the unrecognized portions of the gains and losses measured over the previous four years. Theoretically, we should get the same answer, and we do. See exhibit 3 in the appendix.

### AMORTIZATION METHODOLOGY

The Annual Required Contribution (ARC) defined under Governmental Accounting Standards No. 25 is calculated as the sum of normal cost plus an amount that will pay off the unfunded accrued liability over 30 years. The amortization payment assumes payroll will increase 4.5% per year for non-MUS TRS members. TRS-MUS member payroll is scheduled to decrease as these members terminate and retire, and are not replaced by new MUS members since they participate in an Optional Retirement Plan (ORP). An additional contribution of 4.04% of payroll for Montana University System employees participating in the ORP is made to pay off unfunded liabilities for MUS members of TRS. This contribution is necessary since the MUS unfunded liability is amortized assuming an increasing payroll of MUS, both TRS and ORP members. The MUS unfunded liability was not part of the 2004 actuarial valuation report, and therefore, was not part of our review.

The unfunded liability for the system is calculated including both TRS general employees and MUS employees participating in TRS, and the present value of the additional ORP member contributions are subtracted. This results in a net unfunded liability to be paid for by a percent of pay contribution

## SECTION V.            ACTUARIAL METHODS

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based on compensation of both general employees and TRS-MUS members. It is the Retirement Board's policy to meet the 30-year amortization standard under GASB No. 25. If the contributions being paid are not sufficient to pay the normal cost and amortize the net unfunded liability over 30 years, then the system funding policy and the GASB standard are not being met. It is the Retirement Board's policy to seek increased funding if the 30-year amortization period is not met.

## SECTION VI. ACTUARIAL VALUATION RESULTS REVIEW

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This section of our review discusses the following aspects of the actuarial valuation results:

- Results of Mellon's actuarial valuation calculations with comparison to Milliman report.
- Content of the actuarial reports with regard to disclosure of actuarial assumptions, plan provisions, data considered, actuarial methods, valuation procedures, assets, and other information that another actuary, unfamiliar with the situation, would require to appraise the finding.
- Adequacy of the information provided in the actuaries' reports with regard to analysis of gains and/or losses and the effect of changes in plan provisions, actuarial assumptions, and actuarial methods.
- Compliance with the disclosure requirements of Governmental Accounting Standards Board.

### ACTUARIAL VALUATION RESULTS

As part of our review, Mellon requested and received member data from both TRS and Milliman. Our process included a replication of the 2004 actuarial valuation results. We also reviewed sample member calculations to ensure that they valued the correct benefit levels, used the correct assumptions and calculated the liabilities correctly on an individual basis.

Generally accepted actuarial standards and practices provide actuaries with the basic mathematics and the framework for calculating the actuarial results. When it comes to applying those actuarial standards to complex calculations, differences may exist due to individual opinion on the best way to make those complex calculations. Although this may lead to differences in the calculated results, these differences should not be material. There is no generally accepted degree to which results can differ to be considered material. However, we generally look for liability (present value) results that differ from another actuary's calculations by no more than 1%. Actuaries can differ on how the liability values should be determined, split between past and future service, so we will typically accept a higher difference of 3% for normal cost.

We reviewed sample member calculations sent to us by Milliman for several active and inactive members and found our results were a close match. In addition, our results for the calculation of liabilities for the full actuarial valuation were within acceptable levels of materiality. Our conclusions for this review are summarized as follows:

- Decrements correctly coded for retirement, disability, death, and withdrawal
- Benefit levels correctly calculated for retirement, disability and death
- Eligibility for the different benefits correctly calculated
- 1.5% COLA provision deferred 3 years and correctly valued
- Salaries properly annualized and projected correctly
- Present value of benefits is within 1%.

## SECTION VI. ACTUARIAL VALUATION RESULTS REVIEW

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- Service was calculated and projected correctly
- Missing data reasonably filled
- Treatment of service and salary for part-time members was reasonable
- Retired benefits for each optional form of payment valued correctly
- Present value of future normal costs were within 1%
- Normal cost rate is within 1%
- Total employer contribution rate needed to pay the normal cost and amortize the unfunded liability over 30 years is within 1%
- Recommended contribution increases are reasonable, provided the MUS unfunded liability is amortized by the MUS-ORP member contribution

We concur with Milliman's conclusion that the contribution rate should be increased by at least 2.8% of pay in order to meet the 30-year amortization period. This is a significant contribution increase when compared to the current rate. During the last actuarial valuation completed in 2002, the contribution rate was sufficient to meet the 30-year amortization period. Much of the change is due to delayed investment losses that have significantly increased the unfunded liability, from \$383.5 million in 2002 to \$757.8 million in 2004 per Milliman's report.

Most large statewide public pension systems perform actuarial valuations annually. An internal survey of Mellon's statewide public pension fund clients found that all 22 systems perform the actuarial valuation annually. The South Dakota Retirement System had performed biennial valuations until 1996, but changed to annual valuations to improve disclosure. Annual valuations can detect funding shortfalls and declining funding rates sooner, thereby giving policy makers a head start in addressing funding needs.

Detailed results of our 2004 actuarial valuation with a comparison to Milliman's results can be found in the appendix. Our liabilities for active member disability and survivor benefits was more than 10% higher than Milliman. However, since our service retirement liability was less, and our total liability was within 1%, we do not see this difference as material.

In order to verify the increase in the contribution rate needed to amortize the unfunded liability over 30 years, we developed a chart that includes a projection of annual compensation and annual changes expected in the contribution rate. We were able to verify Milliman's results using a different methodology. See exhibits 7 and 8 in the appendix for our analysis.

**Recommendation:** In order to improve disclosure and identify funding increase needs sooner, we recommend the actuarial valuations be performed annually. The next actuarial valuation of TRS should be performed as of July 1, 2005 and every July 1<sup>st</sup> thereafter.

## SECTION VI. ACTUARIAL VALUATION RESULTS REVIEW

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### CONTENT OF THE ACTUARIAL REPORTS

The American Academy of Actuaries has stated, “The form and content of any actuarial communication should meet the needs of the particular circumstances, taking into account the knowledge and understanding of the users and the actuary’s relationship to the users.” Therefore, the form and content of an actuarial report may vary considerably from one actuary or plan to another.

However, the Academy has issued the Actuarial Standard of Practice No. 4, which deals with measuring pension obligations and communicating the results. They list specific elements to be included, either directly or by references to prior communication, in pension actuarial communications. Some of the elements would not be pertinent in all communications, but since an actuarial valuation report is the most complete picture of the actuarial status of the plan, all the elements listed should be covered in the report, even if only briefly.

The following is a list of the specific elements:

- The name of the person or firm retaining the actuary and the purposes that the communication is intended to serve.
- An outline of the benefits being discussed or valued and of any significant benefits not included in the actuarial determinations.
- A statement as to the effective date of the calculations, the date as of which the participant and financial information were compiled, and the sources and adequacy of such information.
- A summary of the participant information, separated into significant categories such as active, retired, and terminated-vested. Actuaries are encouraged to include a detailed display of the characteristics of each category and a reconciliation with prior reported data.
- A summary of asset information and derivation of the actuarial value of assets. Actuaries are encouraged to include an asset summary by category of investment and a reconciliation with prior reported assets showing total contributions, benefits, investment return, and any other reconciliation items.
- A description of the actuarial assumptions and cost method and the asset valuation method. Changes in assumptions and methods from those used in previous communications should be stated and their effects noted. If the actuary expects that the long-term trend of costs resulting from the continued use of present assumptions and methods would result in a significantly increased or decreased cost basis, this should also be communicated.
- A statement of the findings, conclusions, or recommendations necessary to satisfy the purpose of the communication and a summary of the actuarial determinations upon which these are based. The communication should include applicable actuarial information regarding financial reporting. Actuaries are encouraged to include derivation of the items underlying these actuarial determinations.
- A disclosure of any facts which, if not disclosed, might reasonably be expected to lead to an incomplete understanding of the communication.

## SECTION VI. ACTUARIAL VALUATION RESULTS REVIEW

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We have reviewed the actuarial valuation report prepared by Milliman in 2004. The Milliman report contained all of the elements required by ASOP No. 4. The reports included historical information and several additional summaries of the member data and asset information.

### RECOMMENDATIONS FOR THE REPORT

We have the following suggestions we believe will improve the communication of actuarial valuation results to interested parties:

- The determination of the contribution rate needed to amortize the unfunded accrued liability should be expanded to show the compensation used in developing the amortization rate and the contribution rate pattern over the 30-year period.
- The summary of actuarial gains and losses should be expanded to include all sources of decremental changes, including retirement, withdrawal, disability, and pre-retirement mortality. In addition, the impact these gains and losses have on changes to the unfunded accrued liability should be shown.
- A description of the calculation of the normal cost under the Entry Age Cost Method should state how the normal cost is computed, on an individual or aggregate basis.
- A description of the procedures used to fill in missing data elements should be added.
- In addition to contribution rates, show a historical summary of annual compensation for non-MUS TRS members, TRS-MUS members, and ORP members.
- The development of the MUS unfunded liability should be included in the actuarial valuation report to show the appropriateness of ORP member contribution rates.
- The disclosure information required under Governmental Accounting Standards Board (GASB) No. 25 was missing. A Schedule of Funding Progress and Schedule of Employer Contributions for the prior six-year period should be added. The Notes in the Trend Data should be added to summarize the actuarial assumptions and methods used to calculate the Annual Required Contribution (ARC), and the ARC should be clearly identified.

## SECTION VII. CONCLUSIONS

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As independent reviewing actuary, Mellon has been asked to provide an opinion and recommendations for the improvement of the actuarial valuation performed by TRS's retained actuarial firm, Milliman. The purpose of this review is to provide assurance to the TRS Retirement Board that the valuation was conducted using complete and valid information, the actuarial assumptions and methods were consistent with generally accepted actuarial standards and procedures, the sample life calculations are accurate, and the actuarial report fully and fairly discloses the actuarial position of TRS's retirement funds.

The TRS Retirement Board has adopted a funding policy that will pay the accruing retirement benefits, or normal cost, and amortize any unfunded actuarial accrued liability over a period not to exceed 30 years as a level percentage of active member payroll. Mellon has independently reviewed the actuarial valuation, replicating the actuarial valuation results and calculations for several sample members as of July 1, 2004.

From our full scope review of the plan, we believe the actuarial valuation of TRS prepared by Milliman fairly represent the actuarial position and funding requirements of the retirement system. As discussed throughout this report, we have made suggestions that we believe will enhance the actuarial valuation process and reports of the TRS actuary.

**Exhibit 1**

**Teachers Retirement System of Montana**

**Actuarial Present Value of Future Benefits  
as of July 1, 2004  
(\$ in millions)**

	<b><u>Mellon</u></b>	<b><u>Milliman</u></b>	<b><u>Percent Difference</u></b>
<b>A. Active Members</b>			
Service retirement	\$1,802.4	\$1,813.3	-0.6%
Disability retirement	24.0	21.5	11.6%
Survivors' benefits	47.5	42.7	11.2%
Vested retirement	31.9	31.5	1.3%
Refund of member contributions	30.7	31.7	-3.2%
Total	\$1,936.5	\$1,940.7	-0.2%
<b>B. Inactive members and annuitants</b>			
Service retirement	\$1,663.4	\$1,675.1	-0.7%
Disability retirement	17.1	17.1	0.0%
Beneficiaries	108.5	107.2	1.2%
Vested terminated members	53.7	54.6	-1.6%
Nonvested terminated members	11.1	11.3	-1.8%
Total	\$1,853.8	\$1,865.3	-0.6%
<b>C. Grand Total</b>	<b>\$3,790.3</b>	<b>\$3,806.0</b>	<b>-0.4%</b>

**Exhibit 2**

**Teachers Retirement System  
State of Montana**

**Normal Cost Contribution Rates  
As Percentages of Salary**

	<b><u>Mellon</u></b>	<b><u>Milliman</u></b>	<b><u>Percent Difference</u></b>
Service retirement	7.76%	7.87%	-1.4%
Disability retirement	0.17%	0.15%	12.7%
Survivors' benefits	0.32%	0.26%	21.5%
Vested retirement	0.64%	0.63%	0.9%
Refund of member contributions	<u>1.42%</u>	<u>1.43%</u>	-0.4%
Total	10.31%	10.34%	-0.3%

**Exhibit 3**

**Teachers Retirement System  
State of Montana**

**Development of Actuarial Value of Assets**

	<u>2002-2003</u>	<u>2003-2004</u>
MVA at BOY	2,041,682,520	2,123,634,260
Contributions	104,252,279	107,927,036
Benefit Payments	146,697,820	156,113,866
Expected return at 8%	<u>161,636,780</u>	<u>167,963,268</u>
Expected MVA EOY	2,160,873,759	2,243,410,698
Actual MVA EOY	<u>2,123,634,260</u>	<u>2,354,844,198</u>
Gain / (Loss)	(37,239,499)	111,433,500
20% recognition	<u>(7,447,900)</u>	<u>22,286,700</u>
80% unrecognized	(29,791,599)	89,146,800
60% unrecognized	(203,325,109)	(22,343,699)
40% unrecognized	(124,209,679)	(135,550,072)
20% unrecognized	<u>(736,828)</u>	<u>(62,104,840)</u>
Total unrecognized	(358,063,215)	(130,851,811)
AVA at EOY	2,481,697,475	2,485,696,009
AVA as a % of MVA	117%	106%

**Exhibit 4****Teachers Retirement System  
State of Montana****Unfunded Actuarial Accrued Liability  
(\$ in millions)**

	<b><u>Mellon</u></b>	<b><u>Milliman</u></b>	<b><u>Percent Difference</u></b>
A. Actuarial present value of all future benefits for present and former members and their survivors	\$3,790.3	\$3,806.0	-0.4%
B. Less actuarial present value of total future normal costs for present members	<u>445.6</u>	<u>446.8</u>	-0.3%
C. Actuarial accrued liability	\$3,344.7	\$3,359.2	-0.4%
D. Less actuarial value of assets available for benefits	<u>2,485.7</u>	<u>2,485.7</u>	0.0%
E. Unfunded actuarial accrued liability	\$859.0	\$873.5	-1.7%
F. Less present value of future ORP contributions	<u>116.2</u>	<u>115.7</u>	0.4%
G. Unfunded actuarial accrued liability funded by TRS contributions	\$742.8	\$757.8	-2.0%

**Exhibit 5****Teachers Retirement System  
State of Montana****Recommended Contribution Rates  
As Percentages of Salary  
(\$ in millions)**

	<b><u>Mellon</u></b>	<b><u>Milliman</u></b>	<b><u>Percent Difference</u></b>
A. Employer contribution rate	7.58%	7.58%	0.0%
B. Member contribution rate	<u>7.15%</u>	<u>7.15%</u>	0.0%
C. Total contribution rate	14.73%	14.73%	0.0%
D. Less total normal cost rate	<u>10.31%</u>	<u>10.34%</u>	-0.3%
E. Amount available to amortize the unfunded actuarial accrued liability	4.42%	4.39%	0.8%
F. Annual Compensation (BOY)	\$ 571.2	\$ 571.2	0.0%
G. Annual Amortization Payment (BOY)	\$ 24.9	\$ 24.7	0.8%
H. Unfunded Liability	\$ 742.8	\$ 757.8	-2.0%
I. Amortization period from Valuation Date	over 30 yrs.	over 30 yrs.	n/a
J. Total employer contribution rate needed to pay normal cost and amortize unfunded liability over 30 years	10.51%	10.45%	0.6%
K. Additional contribution rate needed to meet 30 year amortization period after first year and reduction of .11% of pay by State during last ten years of period [19-20-604]	2.93%	2.87%	2.2%
L. Contribution rate increase needed in 2005, 2007, 2009 and 2011 to meet 30 year amortization period after first year and reduction of .11% of pay by State during last ten years of period [19-20-604]	0.86%	0.84%	2.5%

**Teachers Retirement System  
State of Montana**

**Present Value of Future MUS Salary and MUS-ORP Contributions**

Payroll growth: 4.50%

<b><u>FYE Year</u></b>	<b><u>Total MUS Salary</u></b>	<b><u>PVF MUS Salary to 2033</u></b>	<b><u>PVF MUS-TRS Salary</u></b>	<b><u>PVF MUS-ORP Salary</u></b>	<b><u>PVF MUS-ORP Contributions</u></b>
2004	\$ 160,157,575				
2005	167,364,666	\$ 3,146,330,816	\$ 270,719,200	\$ 2,875,611,616	\$ 116,174,709
2006	174,896,076	3,216,442,416			
2007	182,766,399	3,284,169,859			
2008	190,990,887	3,348,976,570			
2009	199,585,477	3,410,268,562			
2010	208,566,824	3,467,389,266			
2011	217,952,331	3,519,613,945			
2012	227,760,186	3,566,143,628			
2013	238,009,394	3,606,098,542			
2014	248,719,817	3,638,511,008			
2015	259,912,208	3,662,317,733			
2016	271,608,258	3,676,351,474			
2017	283,830,629	3,679,332,015			
2018	296,603,008	3,669,856,396			
2019	309,950,143	3,646,388,344			
2020	323,897,900	3,607,246,831			
2021	338,473,305	3,550,593,704			
2022	353,704,604	3,474,420,295			
2023	369,621,311	3,376,532,949			
2024	386,254,270	3,254,537,361			
2025	403,635,712	3,105,821,655			
2026	421,799,319	2,927,538,077			
2027	440,780,288	2,716,583,207			
2028	460,615,401	2,469,576,576			
2029	481,343,094	2,182,837,549			
2030	503,003,534	1,852,360,343			
2031	525,638,693	1,473,787,033			
2032	549,292,434	1,042,378,386			
2033	574,010,593	552,982,348			

# APPENDIX

## Exhibit 7

### Teachers Retirement System State of Montana

#### Development of Additional Contribution Rate Necessary to Meet 30 Year Amortization Policy Increase Applied in 2005/2006 Fiscal Year

Discount rate: 7.75%  
Payroll growth inc: 4.50%  
Additional cont %: 2.93%

FYE Year	TRS non-MUS Payroll	TRS MUS Payroll	Total TRS Payroll	Contribution Rate	Amortization Payment	Amort Payment discounted to 7/1/2004	PVF MUS-TRS Salary
2005	\$ 550,816,687	\$ 43,884,900	\$ 594,701,587	4.42%	\$ 24,346,098	\$ 23,454,205	\$ 42,277,225
2006	575,603,438	41,222,600	616,826,038	7.35%	42,318,216	37,835,670	36,856,107
2007	601,505,593	38,648,000	640,153,593	7.35%	44,222,536	36,694,455	32,068,883
2008	628,573,344	35,768,800	664,342,144	7.35%	46,212,550	35,587,662	27,545,071
2009	656,859,145	33,015,400	689,874,545	7.35%	48,292,114	34,514,252	23,596,023
2010	686,417,806	30,223,600	716,641,406	7.35%	50,465,260	33,473,219	20,047,082
2011	717,306,608	27,379,800	744,686,408	7.35%	52,736,196	32,463,586	16,854,581
2012	749,585,405	24,679,700	774,265,105	7.35%	55,109,325	31,484,406	14,099,713
2013	783,316,748	22,005,800	805,322,548	7.35%	57,589,245	30,534,760	11,667,835
2014	818,566,002	19,518,400	838,084,402	7.35%	60,180,761	29,613,758	9,604,617
2015	855,401,472	17,127,800	872,529,272	7.35%	62,888,895	28,720,536	7,822,042
2016	893,894,538	14,920,600	908,815,138	7.35%	65,718,895	27,854,255	6,323,938
2017	934,119,792	12,891,700	947,011,492	7.35%	68,676,245	27,014,103	5,071,007
2018	976,155,183	10,878,700	987,033,883	7.35%	71,766,677	26,199,293	3,971,401
2019	1,020,082,166	9,133,300	1,029,215,466	7.35%	74,996,177	25,409,059	3,094,405
2020	1,065,985,864	7,576,100	1,073,561,964	7.35%	78,371,005	24,642,660	2,382,198
2021	1,113,955,228	6,283,800	1,120,239,028	7.35%	81,897,700	23,899,378	1,833,738
2022	1,164,083,213	5,235,600	1,169,318,813	7.35%	85,583,097	23,178,515	1,417,960
2023	1,216,466,957	4,270,500	1,220,737,457	7.35%	89,434,336	22,479,396	1,073,394
2024	1,271,207,970	3,476,000	1,274,683,970	7.24%	92,060,552	21,475,171	810,854
2025	1,328,412,329	2,842,300	1,331,254,629	7.24%	96,203,277	20,827,428	615,341
2026	1,388,190,884	2,231,000	1,390,421,884	7.24%	100,532,425	20,199,223	448,258
2027	1,450,659,474	1,794,200	1,452,453,674	7.24%	105,056,384	19,589,966	334,566
2028	1,515,939,150	1,378,500	1,517,317,650	7.24%	109,783,921	18,999,085	238,562
2029	1,584,156,412	1,109,500	1,585,265,912	7.24%	114,724,198	18,426,027	178,198
2030	1,655,443,450	881,600	1,656,325,050	7.24%	119,886,786	17,870,253	131,411
2031	1,729,938,406	659,100	1,730,597,506	7.24%	125,281,692	17,331,243	91,179
2032	1,807,785,634	525,100	1,808,310,734	7.24%	130,919,368	16,808,491	67,417
2033	1,889,135,987	420,800	1,889,556,787	7.24%	136,810,739	16,301,507	50,140

Present value of future amortization payments: \$ 742,881,563 \$ 270,573,146  
Unfunded actuarial accrued liability: \$ 742,881,563

# APPENDIX

**Exhibit 8**

## Teachers Retirement System State of Montana

### Development of Additional Contribution Rate Necessary to Meet 30 Year Amortization Policy with Equal Contribution Rate Increases in 2005, 2007, 2009, and 2011

Discount rate: 7.75%  
Payroll growth inc: 4.50%  
Additional cont %: 0.86%

FYE Year	TRS non-MUS Payroll	TRS MUS Payroll	Total TRS Payroll	Contribution Rate	Amortization Payment	Amort Payment discounted to 7/1/2004	PVF MUS-TRS Salary
2005	\$ 550,816,687	\$ 43,884,900	\$ 594,701,587	4.42%	\$ 24,346,098	\$ 23,454,205	\$ 42,277,225
2006	575,603,438	41,222,600	616,826,038	5.28%	30,398,021	27,178,118	36,856,107
2007	601,505,593	38,648,000	640,153,593	5.28%	31,765,931	26,358,361	32,068,883
2008	628,573,344	35,768,800	664,342,144	6.14%	38,607,855	29,731,389	27,545,071
2009	656,859,145	33,015,400	689,874,545	6.14%	40,345,208	28,834,618	23,596,023
2010	686,417,806	30,223,600	716,641,406	7.00%	48,071,281	31,885,311	20,047,082
2011	717,306,608	27,379,800	744,686,408	7.00%	50,234,488	30,923,573	16,854,581
2012	749,585,405	24,679,700	774,265,105	7.86%	58,949,495	33,678,326	14,099,713
2013	783,316,748	22,005,800	805,322,548	7.86%	61,602,223	32,662,507	11,667,835
2014	818,566,002	19,518,400	838,084,402	7.86%	64,374,323	31,677,327	9,604,617
2015	855,401,472	17,127,800	872,529,272	7.86%	67,271,167	30,721,862	7,822,042
2016	893,894,538	14,920,600	908,815,138	7.86%	70,298,370	29,795,217	6,323,938
2017	934,119,792	12,891,700	947,011,492	7.86%	73,461,796	28,896,521	5,071,007
2018	976,155,183	10,878,700	987,033,883	7.86%	76,767,577	28,024,932	3,971,401
2019	1,020,082,166	9,133,300	1,029,215,466	7.86%	80,222,118	27,179,633	3,094,405
2020	1,065,985,864	7,576,100	1,073,561,964	7.86%	83,832,114	26,359,829	2,382,198
2021	1,113,955,228	6,283,800	1,120,239,028	7.86%	87,604,559	25,564,753	1,833,738
2022	1,164,083,213	5,235,600	1,169,318,813	7.86%	91,546,764	24,793,659	1,417,960
2023	1,216,466,957	4,270,500	1,220,737,457	7.86%	95,666,368	24,045,822	1,073,394
2024	1,271,207,970	3,476,000	1,274,683,970	7.75%	98,573,026	22,994,351	810,854
2025	1,328,412,329	2,842,300	1,331,254,629	7.75%	103,008,812	22,300,786	615,341
2026	1,388,190,884	2,231,000	1,390,421,884	7.75%	107,644,209	21,628,140	448,258
2027	1,450,659,474	1,794,200	1,452,453,674	7.75%	112,488,198	20,975,783	334,566
2028	1,515,939,150	1,378,500	1,517,317,650	7.75%	117,550,167	20,343,103	238,562
2029	1,584,156,412	1,109,500	1,585,265,912	7.75%	122,839,924	19,729,506	178,198
2030	1,655,443,450	881,600	1,656,325,050	7.75%	128,367,721	19,134,416	131,411
2031	1,729,938,406	659,100	1,730,597,506	7.75%	134,144,268	18,557,276	91,179
2032	1,807,785,634	525,100	1,808,310,734	7.75%	140,180,761	17,997,544	67,417
2033	1,889,135,987	420,800	1,889,556,787	7.75%	146,488,895	17,454,695	50,140

Present value of future amortization payments: \$ 742,881,563 \$ 270,573,146  
Unfunded actuarial accrued liability: \$ 742,881,563

